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ABSTRACT

The status of statistical sophistication in research on vocational education in the 1980s and changes in the degree of sophistication were studied. Analyses were made of 118 quantitative research articles published in 4 vocational education research journals (28 articles in the "Journal of Vocational Education Research," 50 articles in the "Journal of Agricultural Education," 26 articles in the "Journal of Industrial Teacher Education," and 14 articles in the "Journal of Vocational Home Economics Education"). It was found that the statistical sophistication level of the majority of research in the 1980s was less than advanced. The statistical sophistication of research was related to both the problem area studied and the methodological strategy used. No changes were found in the use of statistical techniques and in the statistical sophistication of research from the early to the late 1980s. Seven tables summarize study findings. (SLD)

The Determination of Statistical Sophistication of Research in Vocational Education

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Abstract

This study examined the status of and changes in the statistical sophistication of research in vocational education in the 1980s. Based on analyses of 118 quantitative research articles published in four vocational education research journals, the study found that the statistical sophistication level of the majority of research in the 1980s was less than advanced. The statistical sophistication of research was related to both the problem area studied and the methodological strategy used. No changes were found in the use of statistical techniques and in the statistical sophistication of research from the early to the late 1980s.

Statistical Sophistication of Research in Vocational Education in the 1980s

The empirical-analytic paradigm of research in vocational education heavily relies on the use of statistics (Smith, 1984). The impact of statistical methods on vocational education research was recognized by many researchers in the field (Cheek, 1988; Warmbrod, 1986; Oliver, 1981).

The use of statistics in educational research can be traced back as early as 1901 when Edward L. Thorndike published his Noted on Child Study (Walker, 1956). However, it was around 1949 that "the era of empirical generalization" finally arrived in educational research (West & Robinson, 1980). In spite of frequent calls from many researchers in vocational education to broaden paradigms for inquiry in the last decade, quantitative research still prevailed in the field during the 1980s (Lynch, 1983; Hillison, 1989).

Research in vocational education and education in general has accumulated a considerable amount of knowledge regarding many aspects of the field. Vocational educators should depend on this valuable information to solve problems or to further our understanding about this profession. Because a great number of research literature used quantitative approach, an issue of technical readability of these reports needs to be addressed. A major factor that affects the readability is the use of statistical techniques in these reports. It is conceivable that the statistical sophistication of a report using simple descriptive statistics is lower than another one applying multivariate techniques, because the full understanding of the later techniques requires readers receiving further training in statistics.

Previous studies concurred that ANOVA, correlations, t-tests,

regression, and chi-square tests were among the most frequently used techniques in educational research. Most studies found that significant changes did not occur within a period of ten years (Willson, 1980; West, Carmody, & Stallings, 1983; Rudolph, McDermott, & Gold, 1985; Elmore & Woehlke, 1988; Eason & Daniel, 1989; Emmons, Stallings, & Layne, 1990). Further examinations indicated that only a small proportion of statistical techniques used was at the "advanced" level (Goodwin & Goodwin, 1985a, 1985b; Teleni & Baldauf, 1989). Unfortunately, only one study was reported on the use of statistical techniques in vocational education (Kelly, Sproles, Camp, Hauser, & Kopf, 1989). Neither the use of specific techniques nor the statistical sophistication level was investigated in that study.

The classification system for statistical sophistication developed by Goodwin and Goodwin (1985a, 1985b) was widely used in later studies. This system categorized descriptive statistics, Pearson correlation, chi-square, t-tests, and one-way ANOVA into the "basic" level, other common univariate analyses (excluding nonparametric techniques) into the "intermediate" level, and multivariate techniques into the "advanced" level. However, previous studies in statistical sophistication were only limited to classify statistical techniques into the three sophistication levels. No studies attempted to study the overall statistical sophistication level of a research report.

Educational research is an ongoing process which starts at the determination of a problem followed by execution of research procedures (Gay, 1979). The subsequent stages of the process, including statistical analysis, are logically influenced by the nature of the research problem and the methodological strategy of a study.

Vocational education research covered a wide range of problem areas (COVERD, 1976; Schwandt, 1983; Seidman, 1985; Kapes & Bartley, 1986; Schultz, 1988; Kelly, Sproles, Camp, Hauser, & Kopf, 1989). On the other hand, several methodological strategies were used in educational research, such as surveys, field studies, and field experiments. It is not clear whether the use of statistical techniques differs among the studies focusing various problem areas or among those applying various methodological strategies.

This study attempted to answer the following three questions: (a) how to describe the level of statistical sophistication of research in vocational education in the 1980s? (b) whether the statistical sophistication of research was related to the problem areas studied and/or to the methodological strategies used? and (c) did the statistical sophistication of research change significantly in the 1980s?

Answers to these questions could not only enhance our understanding of the research process in vocational education but identify some directional changes in the research practice during the 1980s as well. The findings of this study may serve as a basis for setting appropriate statistical competency levels needed by researchers and other professionals in the field.

This study did not assume that the use of advanced statistics should always be desirable. The appropriate choice of statistical techniques in a study should be determined by its objectives, research design, and the nature of the data collected. However, this study made no judgement on the appropriateness of the use of statistical techniques.

Goals and Objectives

The purpose of this study was to describe the status of and changes in

the statistical sophistication of research in vocational education in the 1980s. The study also sought to determine relationships among the statistical sophistication level, the problem area studied, and the methodological strategy used in vocational education research. Specific objectives of the study were to:

1. describe the statistical techniques used and determine the statistical sophistication of research;
2. describe the problem areas studied;
3. determine the relationship between the statistical sophistication of research and the problem area studied;
4. describe the methodological strategies used;
5. determine the relationship between the statistical sophistication of research and methodological strategy used;
6. determine changes over time in the statistical techniques used, the statistical sophistication levels, the problem area studied, and the methodological strategy used in the 1980s.

Methods

Population and Sample

The target population of this study was defined as the quantitative research articles published in the Journal of Vocational Education Research (JVER, N=109), the Journal of Agricultural Education (JAE, formerly the Journal of American Association of Teacher Educators in Agriculture, N=197), the Journal of Industrial Teacher Education (JITE, N=103), and the Journal of Vocational Home Economics Education (JVHEE, N=58) in the 1980s. These four primary research journals are all established with track records so that a

sufficient number of articles could be sampled.

Stratified random samples were drawn from each journal in proportion to its total number of articles published. However, the articles only published in two time periods (a) 1980-83 and (b) 1986-89 were selected. Since JVHEE did not start to publish until 1983, the JVHEE articles only published in 1983 were selected for the period 1980-83. A total sample of 118 quantitative research articles was selected according to Cochran's sample size determination formula with a margin of error of 8% and a .05 α level (Cochran, 1977). The number of articles drawn from JVER, JAE, JITE, and JVHEE was 28, 50, 26, and 14, respectively. Half of the articles from each journal were selected from each of the two time periods.

Instrument Development

The instrument used in this study was developed by the researchers. The instrument reported by Schwandt (1983) was used to classify both the problem areas of study and the methodological strategies used. Each sample article was classified into one of the four problem areas: (a) teacher, (b) student, (c) curriculum, and (d) setting (Steiner's, 1978; Schwandt, 1983). Moreover, the primary methodological strategy of each sample article was classified into one of the following: (a) laboratory experiment, (b) field experiment, (c) field study and ex post facto research, and (d) population and sample surveys (McGrath, 1981; Schwandt, 1983). Only one problem area and one methodological strategy could be classified for each sample article.

A list of statistical techniques was identified according to Goodwin and Goodwin's studies (1985a, 1985b). In order to match each statistical technique in the list with its sophistication level, a panel of 18 experts was used for the validation. The panel members consisted of 15 vocational

education researchers from 12 institutions and 3 statisticians from a major institution. The specific criteria used for the selection of panel members from vocational education were: (a) the candidate's direct involvement in publishing data based research articles, (b) the candidate's experience as a research journal editor, and (c) recommendations from the vocational education faculty at a major institution. Seventeen of the 18 panel members responded.

Each panel member received a mailed questionnaire containing the list of statistical techniques. Each statistical technique listed could be ranked as one of the three levels of sophistication: (a) basic, (b) intermediate, and (c) advanced. In addition, each panel member could either label the listed techniques as "unfamiliar" or list additional statistical techniques along with their corresponding sophistication levels.

In order to establish consistency in rating among the panel members, the three levels of sophistication were operationally defined by the researchers in the instruction of the questionnaire: (a) statistical techniques at the "basic" level should be understood by average readers who have completed one typical graduate level course in statistics; (b) those at the "intermediate" level should be understood by average readers who have completed two typical graduate level courses in statistics; and (3) those at the "advanced" level should be understood by average readers who have passed two typical graduate courses in statistics and at least one advanced course in statistics.

Based on the rating of the panel members, the median sophistication level of each technique was used as its sophistication level. Operationally, the highest level among all techniques reported in an article was defined as its level of statistical sophistication of research.

In order to measure the reliability of the instrument, a pilot study was

conducted on 24 randomly selected articles from the four journals. The data coded included the problem area of the study, the methodology strategy used, each statistical technique reported and its corresponding level of sophistication, and the statistical sophistication of research of each article. A .90 test-retest reliability coefficient of the instrument was calculated by using the following formula:

$$\frac{\text{(\# of Coding Agreements - \# of Coding Disagreements)}}{\text{(\# of Total Coding)}}$$

Data Collection and Analysis

Articles in the sample were analyzed and coded upon their availability to the researchers. Data collection was completed over a period of one month. During the data collection stage, the researchers read each sample article in its entirety. When more than one problem area was studied in one article, the problem area of that study was determined by the primary dependent variable investigated. On the other hand, if more than one strategy was used by a study, the dominant strategy used to gain knowledge about the major problem area was determined as the methodological strategy used by that study. Furthermore, if the same statistical technique was cited or used more than once in a single article, it was coded only once. Descriptive statistics, Spearman rank-order correlation, t-tests, and chi-square tests were used in data analysis. An α level of .05 was used in inferential statistics.

Findings

A total of 30 different statistical techniques was identified in the sample, ranging from simple descriptive statistics to multivariate techniques (Table 1). About 57% (n=67) of the sample articles were classified as "basic"

in the level of statistical sophistication of research, 25% (n=30) as "intermediate", and 18% (n=21) as "advanced". About 94% of the sample articles (n=111) reported at least one type of descriptive statistic, whereas 88% of them (n=104) used at least one correlational-inferential statistical technique.

Insert Table 1 about here

The number of correlational-inferential statistical techniques reported per article ranged from 0 to 5, with the mean and median of 1.66 (SD=1.22) and 2, respectively. The most frequently used correlational-inferential techniques were identified as t-tests (n=33), Pearson correlation (n=32), one-way ANOVA (n=30), chi-square (n=18), multiple linear regression (n=12), factor analysis (n=12), and post-hoc multiple comparisons (n=11).

The reported techniques were further grouped into eight clusters (Table 2). The techniques listed under the cluster "ANOVAs" included one-way ANOVA, factorial ANOVA, and one-way ANCOVA. Pearson r, Spearman rho, Kendall's tau, Kendall coefficient of concordance, part/partial correlation, and other correlations were grouped together under "correlations". "Multivariate" techniques included factor analysis, MANOVA/MANCOVAs, discriminant analysis, path analysis, canonical correlation, cluster analysis, and LISREL. The techniques listed under the cluster "nonparametric" included Kolmogorov-Smirnov tests, Kruskal-Wallis one-way ANOVA, Wilcoxon rank sum test, Fisher's exact test, log-linear analysis, and omega-squared. Simple linear regression, and multiple linear regression were grouped under the cluster "regressions". However, planned orthogonal comparisons and post-hoc multiple comparisons were

not included in any of the above categories because their use required the presence of ANOVAs. The most frequently used techniques by clusters were found in "descriptive", "correlations", and "ANOVAs", whereas the least frequently used techniques by clusters were found in "regressions" and "nonparametric".

Insert Table 2 about here

About 38% (n=45) of the sample articles were focused primarily on the problem area of "curriculum"; 25% (n=30) were on "teacher"; 23% were on "setting"; and only 14% (n=16) were on "student". A significant relationship was found between the problem area studied and the statistical sophistication of research (χ^2 (6, n=118) = 20.59, p = .02). Research on "student" tended to have a higher proportion classified as advanced statistical sophistication; research on "curriculum" tended to have a higher proportion classified as intermediate statistical sophistication; and research on "setting" tended to have a higher proportion classified as basic statistical sophistication (see Table 3).

Insert Table 3 about here

The study also found that 57% (n=67) of the sample articles used "survey" as the primary methodological strategy; 29% (n=34) used "field study and ex post facto research"; 13% (n=15) used "field experiment"; and very few (1%, n=2) used the "laboratory experiment" strategy. A significant relationship was also found between the methodological strategy used and the

statistical sophistication of research (χ^2 (4, n=118) = 14.11, p = .007). Since only two cases were reported using "laboratory experiment" strategies, a category "experiment", which combined both "laboratory experiment" and "field experiment", was used in performing the chi-square test. Those research articles using "survey" or "experiment" as the primary strategy tended to have higher proportions classified as basic sophistication, whereas those using "field study and ex post facto research" tended to have equal distribution at the three sophistication levels (see Table 4).

Insert Table 4 about here

Statistical techniques in the eight clusters were further broken down by the two time periods in order to make comparisons (see Table 2). Only slight differences were found in the frequencies and ranks of the clusters between the two periods. A Spearman rank-order correlation coefficient (ρ) of .96 suggested that there was a very high degree of consistency in the type of statistical techniques reported between the two time periods.

In addition, average use of 1.76 (SD=1.29) and 1.56 (SD=1.15) correlational-inferential techniques per article were found in the 1980-83 and 1986-89 periods, respectively. An independent t-test was used to determine whether there was a significant difference on the average numbers between the two periods. The result (t(116) = .90, p = .37) suggested that, on average, a similar number of correlational-inferential techniques was used per article in the early and late 1980s. Moreover, no significant change occurred in the level of statistical sophistication of research in vocational education between the early 1980s and the late 1980s (χ^2 (2, n=118) = .063, p = .97)

(see Table 5).

Insert Table 5 about here

Chi-square tests of homogeneity were used to determine whether the problem area studied and the methodological strategy used differed between the early and late 1980s. No significant differences were found in either the problem areas studied (χ^2 (3, n=118) = 2.02, p = .57) or the methodological strategies used (χ^2 (2, n=118) = .662, p = .72) in vocational education research between the two time periods (Table 6 & 7).

Insert Tables 6 & 7 about here

Conclusions and Discussions

Based on the findings of this study, the following three conclusions can be made:

1. the statistical sophistication level of research of the majority of studies in vocational education in the 1980s should be described as "basic", while only a few of them should be described as "advanced";

2. the statistical sophistication of research was related to both the problem area studied and the methodological strategy used among studies in vocational education;

3. the statistical sophistication of research did not change from the early 1980s (1980-83) to the late 1980s (1986-89) among studies in vocational education.

The very basic statistical techniques, such as t-tests, Pearson correlation, and one-way ANOVA, were among the most frequently used ones in vocational education research, which concurred with the previous findings in other fields of behavioral research (Edginton, 1964, 1974; Cartney, 1970; Willson, 1980; West, Carmody, & Stallings, 1983; Rudolph, McDermott, & Gold, 1985; Goodwin & Goodwin, 1985a, 1985b; Elmore & Woehlke, 1988; Eason & Daniel, 1989; Jarrell, Johnson, Chisom, & Hughes, 1989; Teleni & Baldauf, 1989; Emmons, Stallings, & Layne, 1990). The similarity in the use of statistics between research in vocational education and in other fields of behavioral science was also evident in that most sophisticated techniques were infrequently applied (Goodwin & Goodwin, 1985a, 1985b; Teleni & Baldauf, 1989). Goodwin and Goodwin's studies (1985a, 1985b) on the AERJ articles (American Educational Research Journal) from 1979 to 1983 indicated that 33%, 37% and 17% of the statistical techniques reported were at basic, intermediate, and advanced levels, respectively, whereas these figures were 35.3%, 43.1%, and 11.7% on the JEP articles (Journal of Educational Psychology) during the same period. Teleni and Baldauf's (1989) study showed that 63%, 28%, and 9% of the statistical techniques used in published linguistics studies during 1980-86 were basic, intermediate, and advanced, respectively.

From a practical standpoint of view, graduate programs of vocational education should ensure the inclusion of those statistical techniques at the basic and intermediate levels so that the graduates can understand the statistical aspect of most research literature in the field. On the other hand, future researchers in the field may consider additional preparation in statistics in order to comprehend some of the advanced techniques which were

used in one-sixth of the current research literature in vocational education. Joint efforts between vocational education and other fields of education should be considered in offering statistics courses at all levels due to the similarity in the use of statistical techniques across the fields.

A major conceptual difference should be noted between this study and previous ones on the level of statistical sophistication. The focus of this study was on the statistical sophistication of research which was determined by the highest level of sophistication among all the statistical techniques used in a study. In contrast, all the previous literature focused on examining the sophistication levels of statistical techniques themselves. Due to this conceptual difference, any comparisons of findings on this aspect should be conducted cautiously.

Research in vocational education is a logical process with interrelated procedures. Statistical techniques are used in accordance with the purposes and strategies of the study. The nature of the relationships between the statistical sophistication of research and the problem area studied as found in this study was difficult to explain. One speculation is that research data on "student" are more accessible. As a result, more variables could be investigated in a single study. On the other hand, research on "setting" might rely on sources other than the school system to collect useful data. The limited access to useful information means fewer variables can be investigated in a study. Such speculation is based on the assumption that statistical techniques involving more variables tend to be more sophisticated.

This study confirmed the findings of many previous studies that "survey" has been the dominant strategy in educational research (Schwandt, 1983; Mannebach & Mckenna, 1984; Jarrell, Johnson, Chisom, & Hughes, 1989; Kelly,

Sproles, Camp, Hauser, & Kopf, 1989). Strong emphasis on a single methodological strategy--"survey"--can be viewed against McGrath's (1981) notion of the "three-horned dilemma". The survey strategy may maximize generalizability, yet it also tends to minimize precision in measurement and realism of context. Several researchers have raised concerns on the heavy dependence on survey strategy in vocational education research (Schwandt, 1983; Mannebach & McKenna, 1984; Burnett, 1986; Hillison, 1990). One way out of this dilemma is to use a variety of methodological strategies in addition to survey across a given problem area in vocational education.

Since survey strategy was frequently used in vocational education research, its appropriateness of use needs to be further studied. How often was that survey strategy used repeatedly in inquiry within a given problem area? Does the nature of vocational education research call for using the survey strategy? And, do researchers in vocational education need surveys more or less than researchers in other fields? Answers for these questions can provide useful evidence to assess the criticism that vocational education research relied too heavily on survey.

The specific nature of the relationship between the statistical sophistication of research and the methodological strategy used may be explained by the different means used to control the threats to internal validity. The less frequent use of advanced statistical techniques in experimental research might be due to the rigorous control of extraneous variables by the design itself. On the other hand, survey research is usually descriptive in nature and does not attempt to establish causal relationships among variables. Again, in this situation, statistical controls are typically not needed. However, in field studies and ex post facto research, attempts

might often be made to establish causal relations among variables. Threats to internal validity cannot normally be controlled by the research design in these situations. Therefore, statistical controls may be used to control threats to internal validity. However, further studies are needed to examine the differences in ways to control threats to internal validity among studies relying on various methodological strategies.

This study found that the use of statistical techniques and the statistical sophistication of research in vocational education did not change significantly in the ten-year time period from the early 1980s to the late 1980s. This conclusion agrees with the findings of some previous studies (Eason & Daniel, 1989; Goodwin & Goodwin, 1985a, 1985b; Willson, 1980) but disagrees with some others (West, Carmody, & Stallings, 1983; Emmons, Stallings, & Layne, 1990).

It is possible that a ten-year time period was too short to allow significant changes to occur in practice of vocational education research. Another plausible explanation for the lack of increase in statistical sophistication might be the heightened awareness and use of paradigms which call into question the traditional measurement and quantification assumptions. The third speculation is that the statistics training received by vocational education researchers has not changed significantly in the last ten to twenty years. The change in the researcher's statistical competency is a prerequisite for any changes to occur in performing statistical analysis. Further studies are needed to access the status of and changes in the statistical competency level of vocational education researchers in the last three decades.

One limitation of this study was the restricted sample size from only

four major research journals in vocational education. Therefore, generalization of the research findings to other populations is not warranted. Moreover, all the available classification systems to categorize the problem areas or the methodological strategies have their pros and cons including Schwandt's (1983) used in this study. Personal bias or other systematic errors could still remain even though a high test-retest reliability coefficient was found in the instrument of this study.

One major development in educational research during the 1980s was the rapid popularization of computer applications. With the assistance of powerful software packages, the performance of sophisticated statistical techniques, especially multivariate techniques, became much easier. One potential side-effect of that is the abusive use of "fancy" statistical techniques. Knapp (1983) characterized such type of misuse as "underdesign and overanalysis". The stability in the use of statistical techniques in vocational education research may signify a likelihood that less of such abuse has occurred in this field. Stability is the most appropriate descriptor of vocational education research in the 1980s.

References

Burnett, M. F. (1986). The theoretical/conceptual framework of research as related to research design. Paper presented at the American Vocational Education Research Association Annual Meeting, Dallas, TX.

Cartney, J. L. (1970). On being scientific: Changing styles of presentation of sociological research. The American Sociologist, 5(1), 30-35.

Cheek, J. G. (1988). Maintaining momentum in vocational education research. Journal of Vocational Education Research, 13(1), 1-17.

Cochran. W. G. (1977). Sampling techniques. New York: John Wiley & Sons.

Committee on Vocational Education Research and Development (1976). Assessing vocational education research and development. Washington, D. C.: National Academy of Sciences.

Eason, S. H., & Daniel, L. G. (1989). Trends and methodological practices in several cohort of dissertations. Paper presented in at the Annual Meeting of the Southeast Educational Research Association, Houston, TX.

Edginton, E. S. (1964). A tabulation of inferential statistics used in psychology journals. American Psychologist, 19, 202-203.

Edginton, E. S. (1974). A new tabulation of statistical procedures used in APA journals. American Psychologist, 29(1), 25-16.

Elmore, P. B., & Woehlke, P. L. (1988). Statistical methods employed in American Educational Research Journal, Educational Researcher, and Review of Educational Research from 1978 to 1987. Educational Researcher, 17(9), 19-20.

Emmons, N. J., Stallings, W. M., & Layne, B. H. (1990). Statistical methods used in "American Educational Research Journal", "Journal of Educational Psychology", and "Sociology of Education" from 1972 through 1987. Paper presented at the Annual Meeting of the American Educational Research Association, Boston, MA.

Gay, L. R. (1979). Educational research: Competencies for analysis and application. Columbus, OH: Charles E. Merrill Publishing Company.

Goodwin, L. D., & Goodwin, W. L. (1985a). Statistical techniques in AERJ articles, 1979-1983: The preparation of graduate students to read the educational research literature. Educational Researcher, 14(2), 5-11.

Goodwin, L. D., & Goodwin, W. L. (1985b). An analysis of statistical techniques used in the Journal of Educational Psychology, 1979-1983. Educational Psychologist, 20(1), 13-21.

Hillison, J. (1990). Using all the tools available to vocational education researchers. Journal of Vocational Education Research, 15(1), 1-8.

Jarrell, M. E., Johnson, V. A., Chisom, B., and Hughes, K. R. (1989). Research methods, statistical procedures, and psychometric integrity of instruments used in Doctor of Education dissertations at the University of Alabama 1984-1988. Paper presented at the Annual Meeting of the Mid-South Educational Research Association, Little Rock, Arkansas, November 8-10, 1989.

Kapes, J. T. & Bartley, D. L. (1986). The theoretical/conceptual framework in vocational education research: State of art. Paper presented at the Annual Meeting of the American Vocational Association Research Association, Dallas, TX.

Kelly, M. E., Sproles, E. K., Camp, W. G., Hauser, D. A., & Kopf, D. W. (1989). The Journal of Vocational and Technical Education: A review of articles submitted and in Print. Journal of Vocational and Technical Education, 5(2), 50-60.

Knapp, T. R. (1983). Communications: Underdesign and overanalysis. Educational Administration Quarterly, 19(2), 108-113.

Lynch, K. B. (1983). Qualitative and quantitative evaluation: Two terms in search of meaning. Educational Evaluation and Policy Analysis, 5(4), 461-464.

Mannebach, A. J., & Mckenna, P. G. (1984). An analysis of research methodology used in agricultural education, 1974-1982. In Proceedings of the research conference in agricultural education, Eastern Region. Sturbridge, MA.

McGrath, J. E. (1981). Dilemmatics: The study of research choices and dilemmas. American Behavioral Scientist, 25(2), 179-210.

Oliver, J. D. (1981). Improving agricultural education research. The Journal of the American Association of Teacher Educators in Agriculture, 22(1), 9-15.

Rudolph, A., McDermott, R. J., & Gold, R. S. (1985). Use of statistics in the Journal of School Health, 1979-1983: A content analysis. Journal of School Health, 55(6), 230-233.

Schwandt, T. A. (1983). A framework for disciplined inquiry in vocational education. Journal of Industrial Teacher Education, 20(3), 49-56.

Schultz, J. B. (1988). The Journal of Vocational Education Research: The present. Paper presented at the Conference of American Educational Research Association, New Orleans, LA.

Seidman, P. F. (1985). Where we have been in vocational education research: A "geologic survey". Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

Smith, B. B. (1984). Empirical-analytic research paradigm research in vocational education. Journal of Vocational Education Research, 9(4), 20-33.

Steiner, E. (1978). Logical and conceptual analytic techniques for educational researchers. Washington, D.C.: University Press of America.

Teleni, V., & Baldauf, R. B., Jr. (1989). Statistical techniques used in three applied linguistics journals: "Language Learning," "Applied Linguistics" and "TESOL Quarterly," 1980-1986: Implications for readers and researchers. Eric Document 312905.

Walker, H. M. (1956). Methods of research. Review of Educational Research, 26(3), 323-344.

Warmbrod, J. R. (1986). Priorities for continuing progress in research in agricultural education. Paper presented at the 35th Annual Southern Region Research Conference in Agricultural Education, North Little Rock, AR.

West, C. K., Carmody, C., & Stallings, W. M. (1983). The quality of research articles in the Journal of Educational Research, 1970 and 1980. Journal of Educational Research, 77(2), 70-76.

West, C. K. $ Robinson, D. G. (1980). Prestigious psycho-educational research published from 1910 to 1974: Types of explanations, focus, authorship, and other concerns. Journal of Educational Research, 73(5), 271-275.

Willson, V. L. (1980). Research techniques in AERJ articles: 1969 to 1978. Educational Researcher, 9(6), 5-10.

Table 1

Frequencies and Ranks of the Statistical Techniques Used

Statistical Techniques	Frequency	Rank
Level 1: Basic		
Descriptive[a]	111	1
t-tests	33	2
Pearson Correlation	32	3
One-Way ANOVA	30	4
Chi-Square	18	5
Spearman rho Correlation	4	12.5
Kendall's Tau Correlation	2	17
Simple Linear Regression	1	25
Level 2: Intermediate		
Multiple Linear Regression	12	6.5
Post-hoc Multiple Comparisons	11	8
One-Way ANCOVA	7	9
Factorial ANOVA	6	10.5
Part/Partial Correlations	4	12.5
Kendall Concordance Coefficient	2	17
Kruskal-Wallis One-Way ANOVA	2	17
Omega-Square	2	17
Other Correlations[b]	1	25
Planned Orthogonal Comparisons	1	25
Fisher's Exact Test	1	25
Wilcoxon Rank Sum Test	1	25
Kolmogorov-Smirnov Tests	1	25
Level 3: Advanced		
Factor Analysis	12	6.5
One-Way MANOVA/MANCOVA	6	10.5
Path Analysis	3	14

(table continues)

Table 1 (continued)

Statistical Techniques	Frequency	Rank
Level 3 Advanced		
Factorial MANOVA/MANCOVA	2	17
Discriminant Analysis	1	25
Canonical Analysis	1	25
Cluster Analysis	1	25
Log-Linear Analysis	1	25
LISREL	1	25

[a]Descriptive statistics included measure of central tendency, measures of variability, frequency, and percentage;

[b]Other Correlations included phi, rank biserial, point biserial, tetrachoric, biserial.

Table 2

Frequencies and Ranks of Statistical Techniques Used by Clusters in the 1980s

Clusters	1980s		1980-83		1986-89	
	Freq	Rank	Freq	Rank	Freq	Rank
Descriptive	111	1	55	1	56	1
Correlations	45	2	23	2	22	2
ANOVAs	43	3	22	3	21	3
t-tests	33	4	16	4	17	4
Multivariate	27	5	15	5	12	5
Chi-square	18	6	11	6	7	7
Regression	13	7	5	7.5	8	6
Nonparametric	8	8	5	7.5	3	8

Table 3

Cross Classification of Statistical Sophistication Levels by Problem Areas Studied

Problem	Statistical Sophistication Level (n/%[a])			Total
	Basic	Intermediate	Advanced	
Teacher	18/60.0	4/13.3	8/26.7	30/100
Student	5/31.3	4/25.0	7/43.8	16/100
Curriculum	23/51.1	16/35.6	6/13.3	45/100
Setting	21/77.8	6/22.2	0/.00	27/100
Total	67	30	21	118/100

Note. χ^2 (6, n=118) = 20.59. p = 0.02

[a]Row percentage.

Table 4

Cross Classification of Statistical Sophistication Levels by Methodological Strategies Used

Strategies	Statistical Sophistication Level (n/%[a])			Total
	Basic	Intermediate	Advanced	
Experiment	9/52.9	6/35.3	2/11.76	17/100
Field Study[b]	12/35.3	10/29.4	12/35.3	34/100
Survey	46/68.7	14/20.9	7/10.5	67/100
Total	67	30	21	118

Note. χ^2 (4, n=118) = 14.11. p = .007

[a]Row percentage

[b]Field study and ex post facto research

Table 5

Cross Classification of Statistical Sophistication Levels by the Two Time Periods

Period	Statistical Sophistication level (n/%[a])			Total
	Basic	Intermediate	Advanced	
1980-83	33/55.9	15/25.4	11/18.6	59/100
1986-89	34/57.6	15/25.4	10/16.9	59/100
Total	67	30	21	118/100

Note. χ^2 (2, n=118) = .063. p = .97

[a]Row percentage.

Table 6

Cross Classification of Problem Areas Studied by the Two Time Periods

Period	Problem Areas (n/%*)				Total
	Teacher	Student	Curriculum	Setting	
1980-83	14/11.9	10/8.5	20/17.0	15/12.7	59/100
1986-89	16/13.6	6/5.1	25/21.2	12/10.2	59/100
Total	30	16	45	27	118/100

Note. χ^2 (3, n=118) = 2.02. p = .568

*Row percentage.

Table 7

Cross Classification of Methodological Strategies Used by the Two Time Periods

Period	Methodological Strategies (n/%[a])			Total
	Experiment	Field Study	Survey	
1980-83	7/5.4	17/14.4	35/29.7	59/100
1986-89	10/8.5	17/14.4	32/27.1	59/100
Total	17	34	67	118/100

Note. χ^2 (2, n=118) = .66. p = .718

[a]Row percentage